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DEVELOPMENT, FABRICATION AND TEST OF XM36E1 FUZE SETTER

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This report describes the program undertaken for the further development, assembly, and testing of the XM36E1 Fuze Setter. The program included the fabrication, test, and delivery of five First Article Acceptance Sample (FAAS) and ten preproduction units that are designed to set the XM587E2/XM724 Electronic Time Fuzes from 0.2 to 199.9 sec in 0.1-sec increments. Setting is accomplished in less than 1 sec with function mode and desired function time selected by means of bidirectional toggle switches on the fuze Cont

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setter. A readout display indicates the set time.The fuze setter is battery powered and requires no field maintenance except re-charging of the battery. Design features incorporated in the fuze setter include self-checking test capability, indication of low battery voltage and the capability of interrogating a fuze to determine its time setting. The circuit configuration employs state-of-the-art components, most of which are available on an off-the-shelf basis, which minimize power consumption. Packaging of the fuze setter allows hand held operation and permits functioning in an artillery ground environment. System tests demonstrate that the system complies with the specific technical requirements, while withstanding selected environmental conditions.

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

LIST OF TABLES

1. INTRODUCTION

This report describes the development, assembly, and test of the latest design of the XM36E1 fuze setter. The program was comprised of several phases, which were conducted between 1 July 1975 and 31 August 1976.

The fuze setter, its operation, and a theoretical description of the system, including timing charts, logic diagrams, and GO and NO-GO gages have been detailed in a final report.(1)

1.1 Fuze Setter Basic Characteristics and Operation

The XM36E1 fuze setter is designed to set the XM587E2/XM724 fuze to a desired function time, ranging from 0.2 to 199.9 sec in 0.1-sec increments. The fuze setter also has the capabilities of setting a fuze to a point detonation (impact) function or interrogating a previously set fuze to recall its set time. Switches on the fuze setter, which may be illuminated for night operation, provide the means for an operator to select the desired function time. Setting is accomplished by placing the fuze setter on the nose of the fuze. Within 1 sec after the electrical contacts of the fuze setter's self-aligning guide are connected, the correct operation of the fuze is verified and the actual time set into the fuze is displayed by the fuze setter's light emitting diodes.

The fuze setter is completely self-contained, and requires no field maintenance, except for recharging its internal battery from various military vehicles. Other capabilities include low battery indication, self-checking test features, remote setting of fuzes, operation over wide operating and storage temperatures, and completely rugged to survive artillery field environments.

1.2 Program Background

The Harry Diamond Laboratories designed and developed both the original electronic time fuze and its associated fuze setter. The fuze went through various stages of design and development to produce an item that is suitable for field testing and usage, and capable of retaining a set time without power. This fuze is designated Fuze, Electronic Time: XM587E2.

(1) Development, Fabrication and Test of XM36E1 Fuze Setter, Harry Diamond Laboratories, HDL-CR-75-228-1 (Nov. 1975).

The XM36E1 fuze setter also went through various phases of design and development. Breadboards were fabricated employing discrete bipolar circuit components and commercially available complementary MOS integrated circuits in dual-in-line packages. Circuit improvements were incorporated as a result of laboratory tests to insure operating reliability. Prototype units were then fabricated utilizing hybrid technology to form circuit subassemblies. Field tests with the prototype fuze setters proved successful. Fairchild conducted a successful design improvement program on the XM36E1 fuze setter that was comprised of off-the-shelf electronic components. This effort was followed by a development program which included production engineering improvements and an engineering test evaluation of the fuze setter.

This program proved highly successful, yielding a fuze setter that was both electronically and environmentally suitable for field usage.

A program was then started to further develop the fuze setter by incorporating minor engineering improvements to negate any deficiencies of the fuze setter. This program would also be used to produce any auxiliary equipment associated with the fuze setter to enhance its employment under actual field conditions. This report outlines the objectives of this program and summarizes the work accomplished to that end.

2. PROGRAM OBJECTIVES

The basic objective of this program was to satisfy all of the necessary technical requirements involved to further develop and test the XM36E1 fuze setter. This included a design review and completion of a technical data package for use in the production of units capable of use in the field. It also included fabrication of auxiliary equipment associated with the fuze setter. The basic tasks to be accomplished were as follows:

(1) Fabricate two gages to electronically and mechanically verify the fuze setter guide linearly and radially under worst-case conditions.

(2) Incorporate the latest fuze design into the fuze setter tester, modify the tester to facilitate ease of testing, and prepare a test equipment manual describing this tester.

(3) Fabricate, test, and deliver a fuze setter breadboard incorporating the latest electrical changes.

(4) Fabricate, test, and deliver five fuze setters for submission as a First Article Acceptance Sample (FAAS), subjecting them to the following environmental tests:

a. Low temperature
b. High temperature
c. Leakage (Immersion)
d. Dust
e. Shock (drop)
f. Vibration (bounce)
g. Electromagnetic interference
h. Humidity

(5) Fabricate, test, and deliver ten fuze setters as a preproduction sample, subjecting them to low and high temperature.

(6) Fabricate, test, and deliver fifteen battery charging cables to mate the fuze setter to the connectors usually found on military vehicles and self-propelled guns used at artillery batteries.

(7) Fabricate, test, and deliver fifteen carrying cases for the fuze setter and its associated equipment, preferably using a modified standard ammunition can.

(8) Design, fabricate, and deliver an operating instruction card for the fuze setter for use in the field by an operator.

3. WORK ACCOMPLISHED

3.1 General

The program commenced on 1 July 1975. Initial efforts were directed at program organization and the assignment of task responsibilities. The majority of the personnel assigned to the program were those already familiar with the project and who had been associated with the previous effort for Harry Diamond Laboratories under Contract Nos. DAAG39-73-C-0024 and DAAG39-73-C-0228.

3.2 Packaging Modifications

The latest design of the XM36E1 fuze setter was revised to include several packaging modifications. These modifications were incorporated into units S/N 201 through S/N 215. Figures 1 through 7 illustrate the various features of the fuze setter.

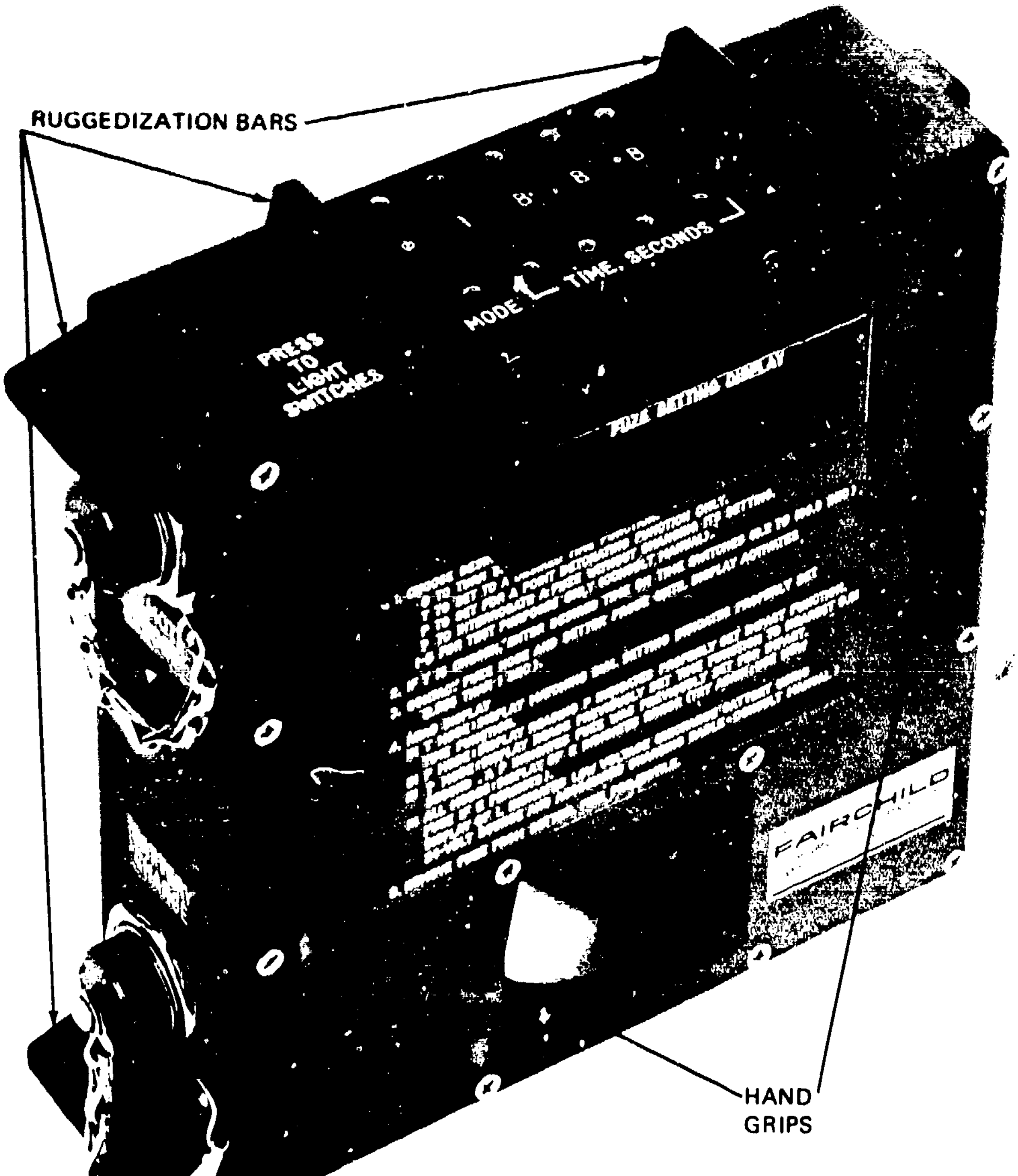

FIGURE 1. XM36E1 FUZE SETTER – FRONT AND TOP VIEWS

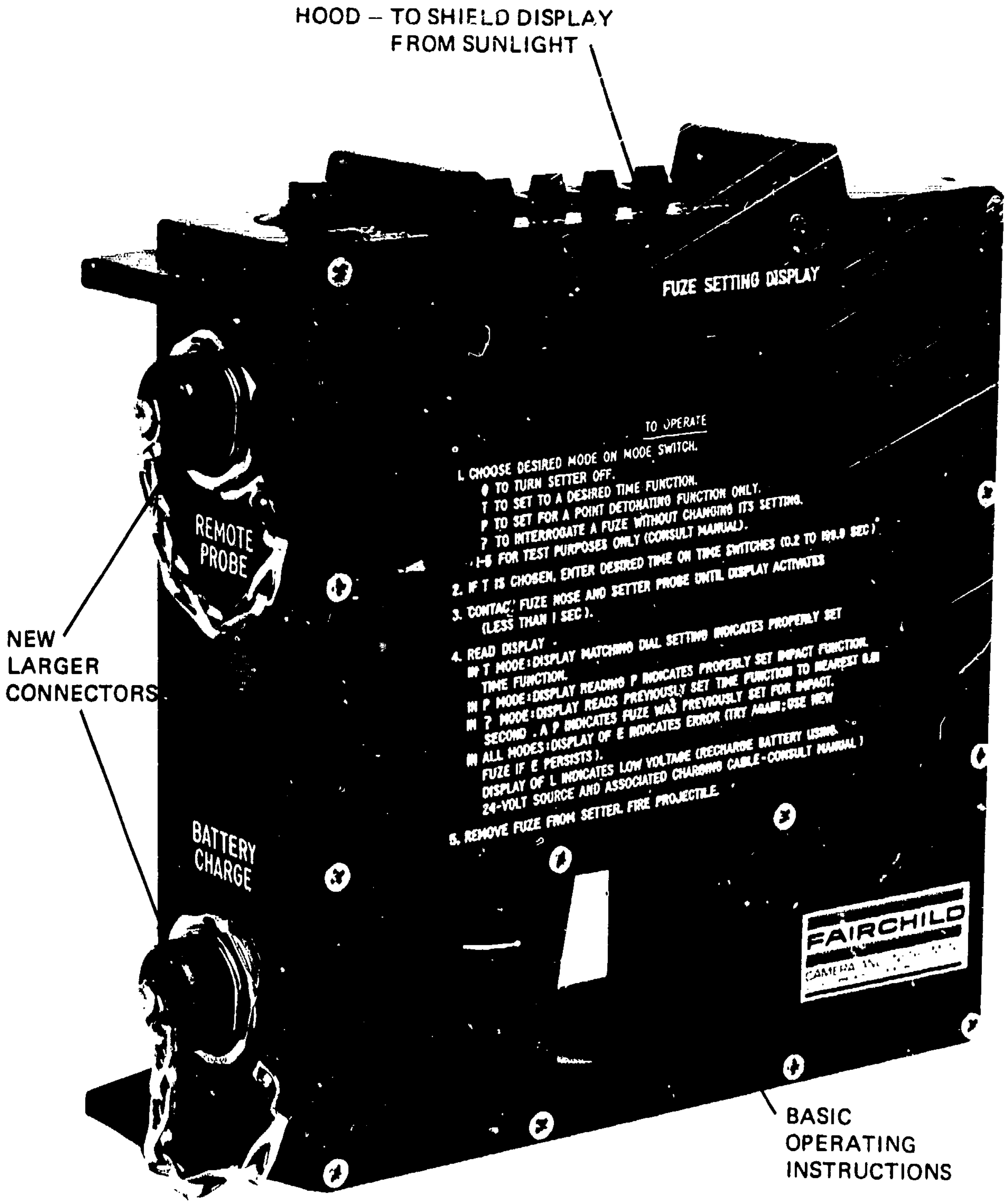

FIGURE 2. XM36E1 FUZE SETTER – FRONT AND SIDE VIEWS

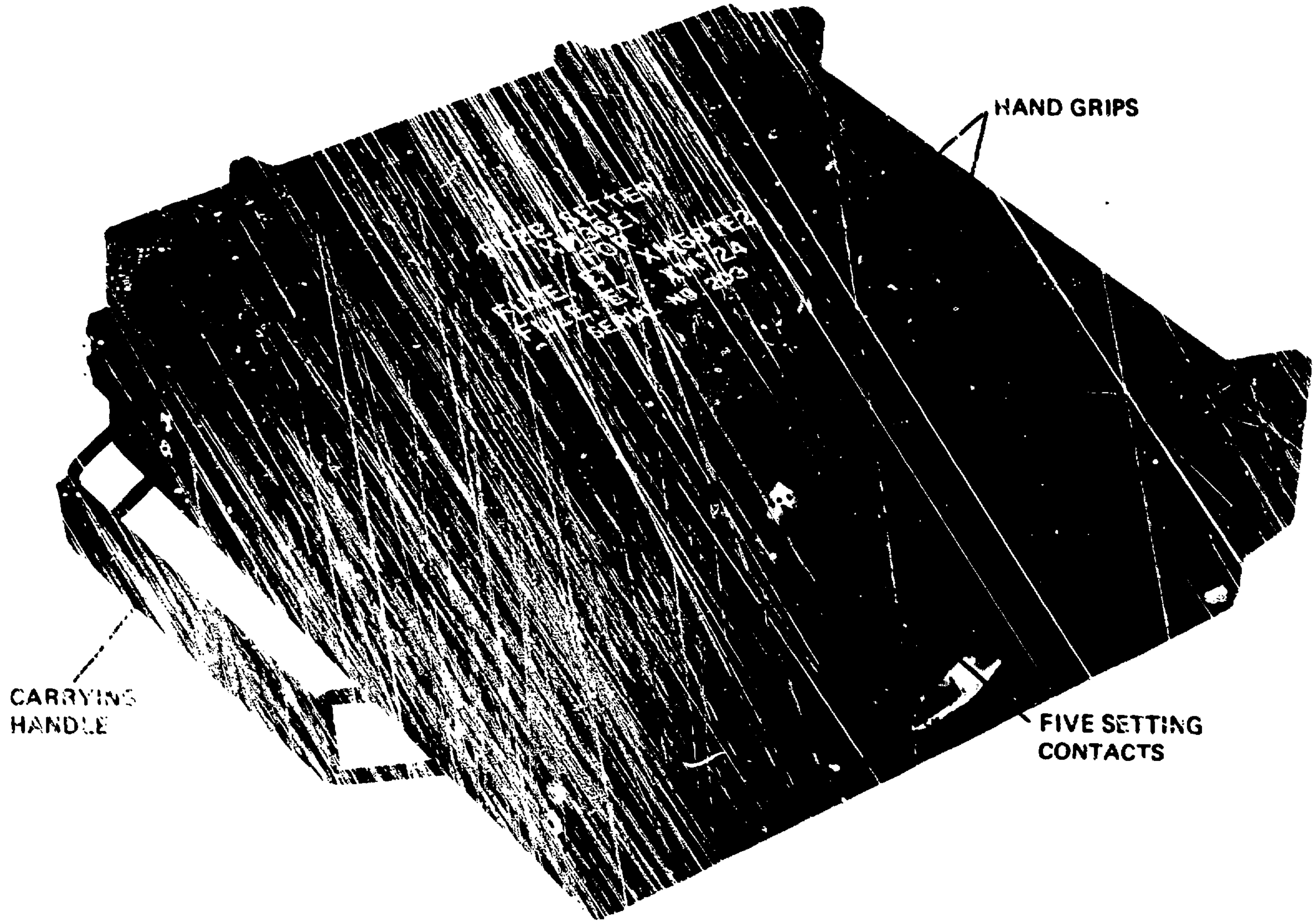

FIGURE 3. XM36E1 FUZE SETTER — REAR AND BOTTOM VIEWS

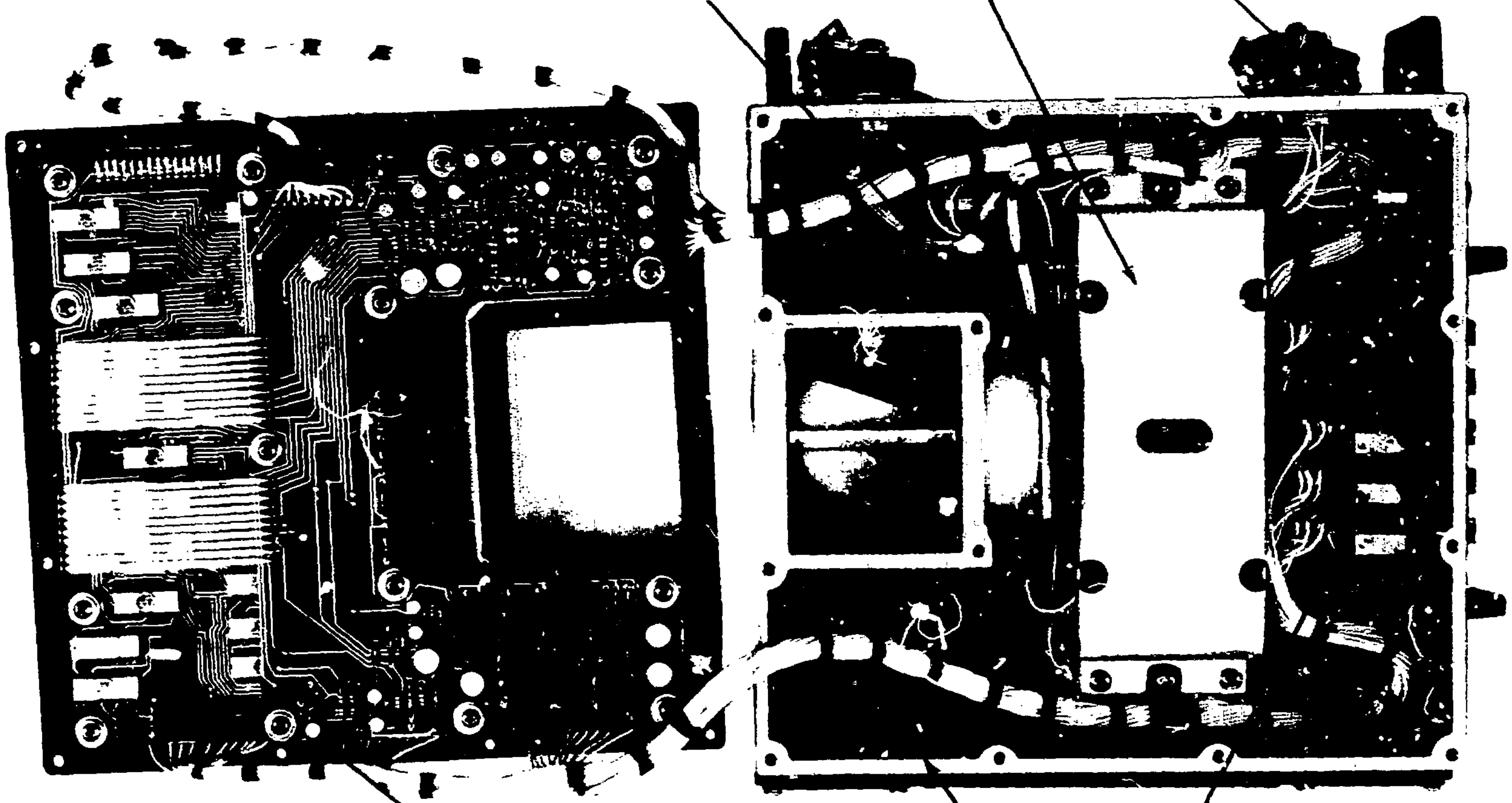

FIGURE 4. XM36E1 FUZE SETTER – INTERNAL VIEW

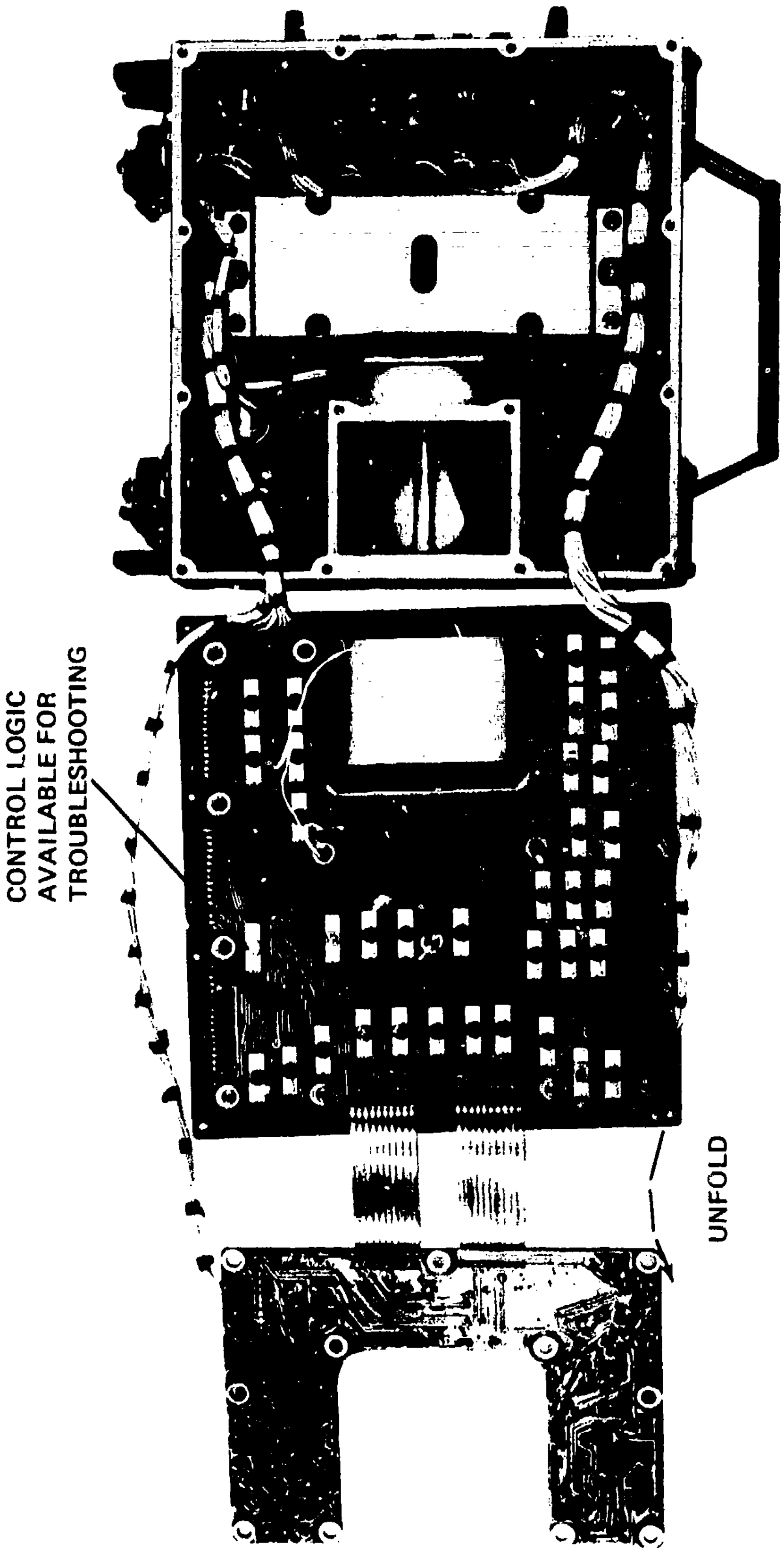

FIGURE 5. XM36E1 FUZE SETTER — PARTIAL DISASSEMBLY

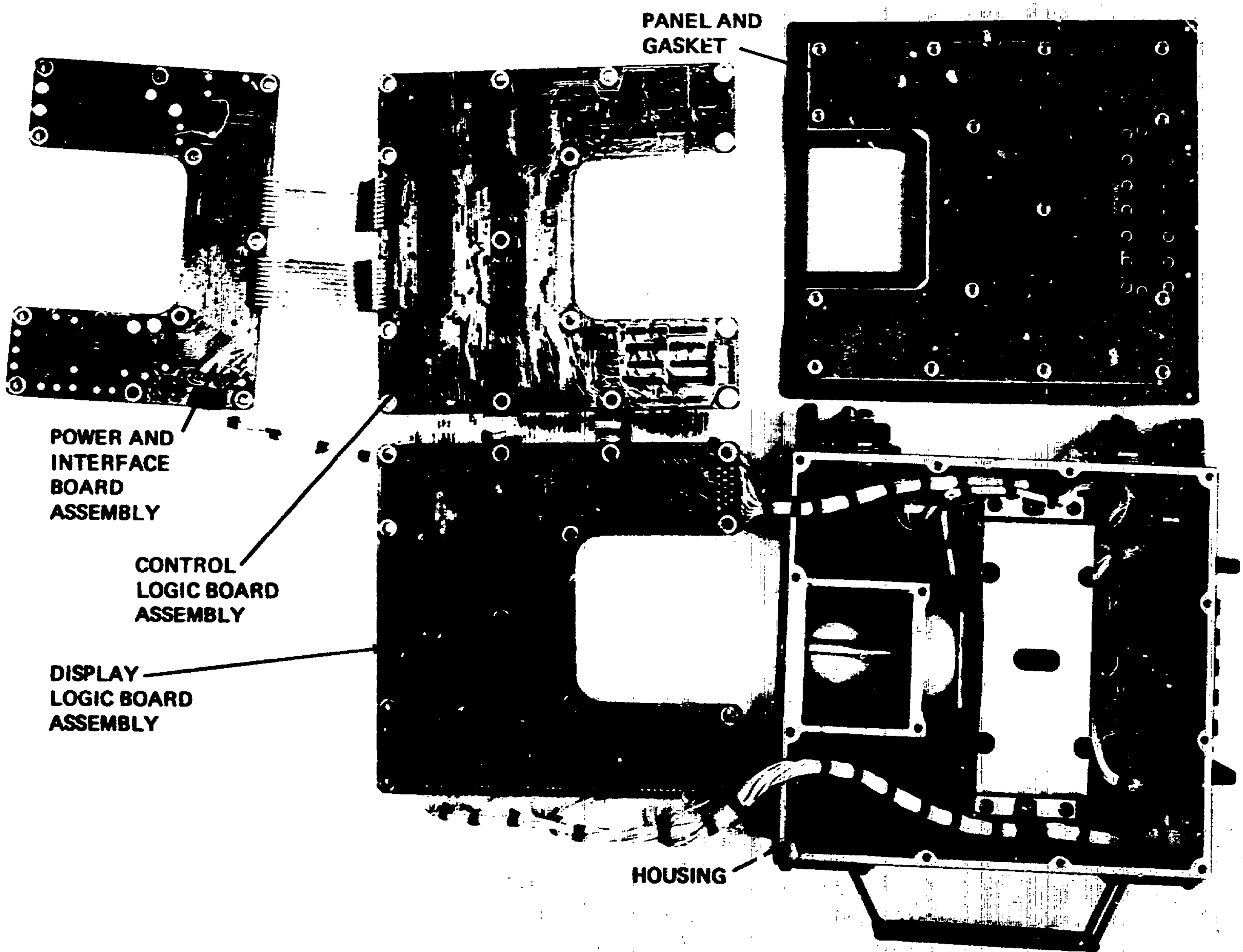

FIGURE 6. XM36E1 FUZE SETTER WITH PANEL REMOVED — TOP VIEW

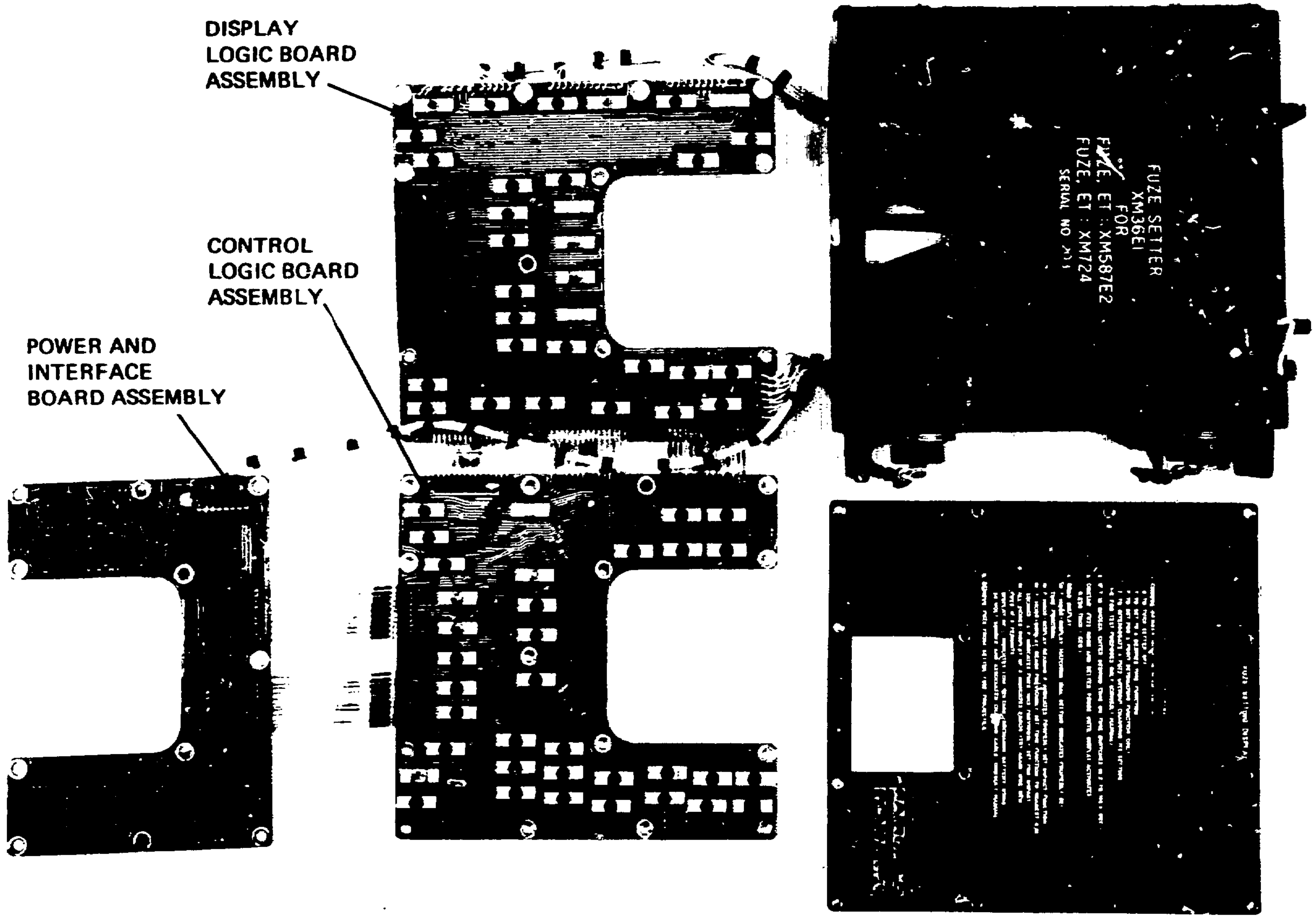

FIGURE 7. XM36E1 FUZE SETTER WITH PANEL REMOVED – BOTTOM VIEW

Figures 1 and 2 show the cast version of the front panel and hood. The panel contains cast "ridges" that provide an operator with hand grips to prevent the fuze setter from slipping during handling. These illustrations also depict the Battery Charge and Remote Probe Connectors, which are larger than those employed in previous units. This enables a rugged cable to be used in conjunction with the connector mates and their associated cable clamps. The remote probe connector was added to facilitate the setting of fuzes, by means of a remote probe and cable, in instances where the fuze setter cannot be placed on the fuze nose cone. The ruggedization bars, which were added to protect these connectors, are also shown in these illustrations.

Figure 3 illustrates the five contacts of the fuze setter guide, which interface with the setting rings of the fuze. The two pairs of symmetric, redundant contacts, about the center one, assist in self-alignment between these fuze setter contacts and the fuze setting rings under worst-case conditions. Also shown are the cast "ridges" on the back of the fuze setter similar to those previously described for the front panel, to prevent slipping.

Figures 4 through 7 illustrate the latest fuze setter package design at various stages of disassembly. The feature of having all components easily accessible for possible troubleshooting or replacement was maintained. Wiring for the new remote probe connector and contact seal printed-circuit board (behind the five contacts) is shown in figure 4. The front-panel standoffs, which were cast as part of the front panel, are shown in figure 6. This method of providing cast standoffs replaced the previous design which required individual standoffs to be press-fit into a plate panel.

3.3 First Article Acceptance Sample (FAAS)

A test program was performed to verify the quality acceptance of five fuze setters which were submitted as FAAS units, S/N 201 through 205. These units were tested in conjunction with Acceptance Test Procedure TP 11711348. Fuze setters S/N 201 and 202 were tested in accordance with phases 1 through 6, and S/N 203, 204, and 205 were tested in accordance with phases 1 through 13. The correct operation of the fuze setter after subjection to each of the environmental tests, as well as after significant stages of testing during each of the environments, was verified using the test setups shown in figures 8 and 9.

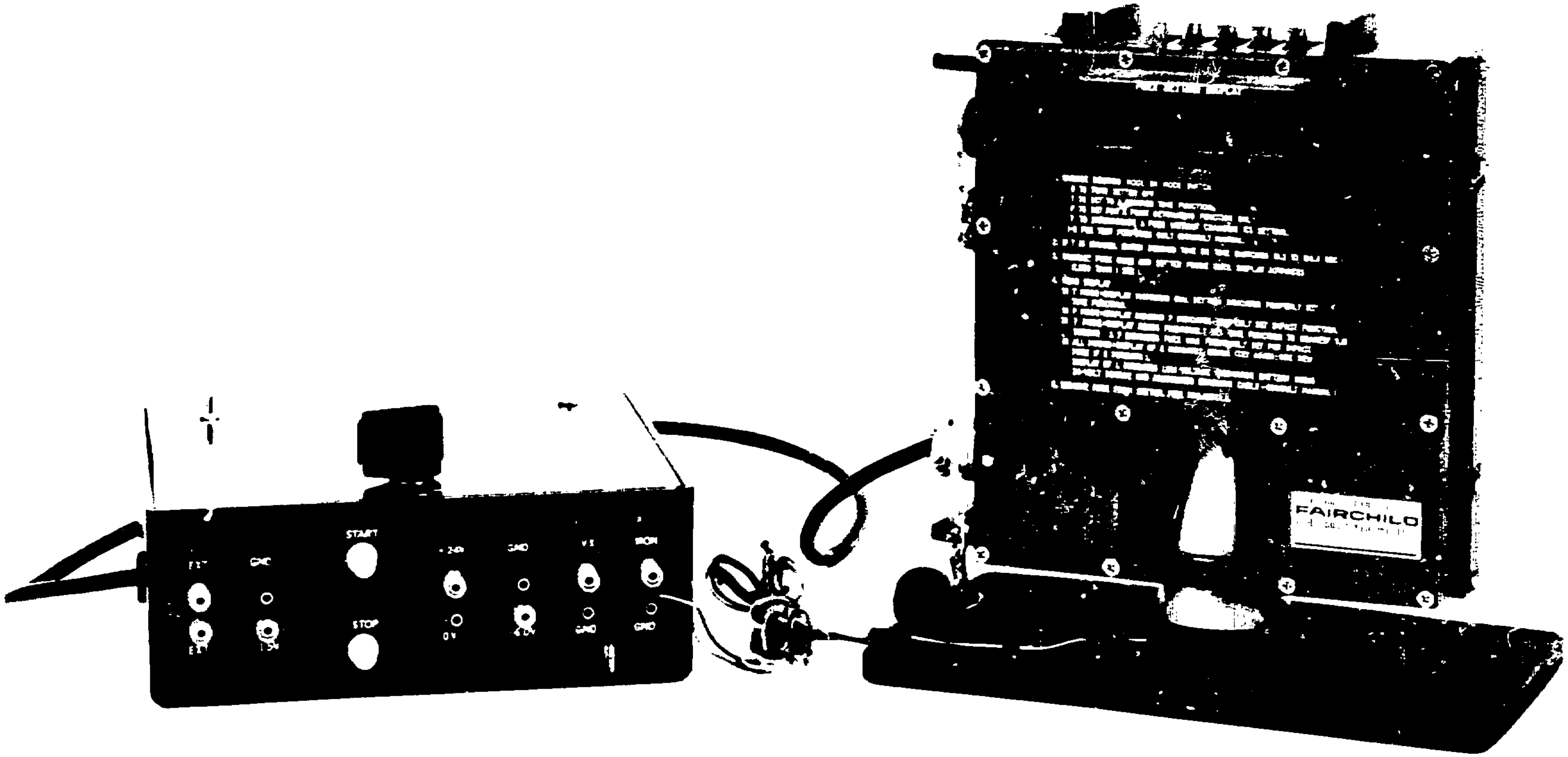

FIGURE 8. XM36E1 FUZE SETTER AND TEST SETUP (USING NOSE CONE)

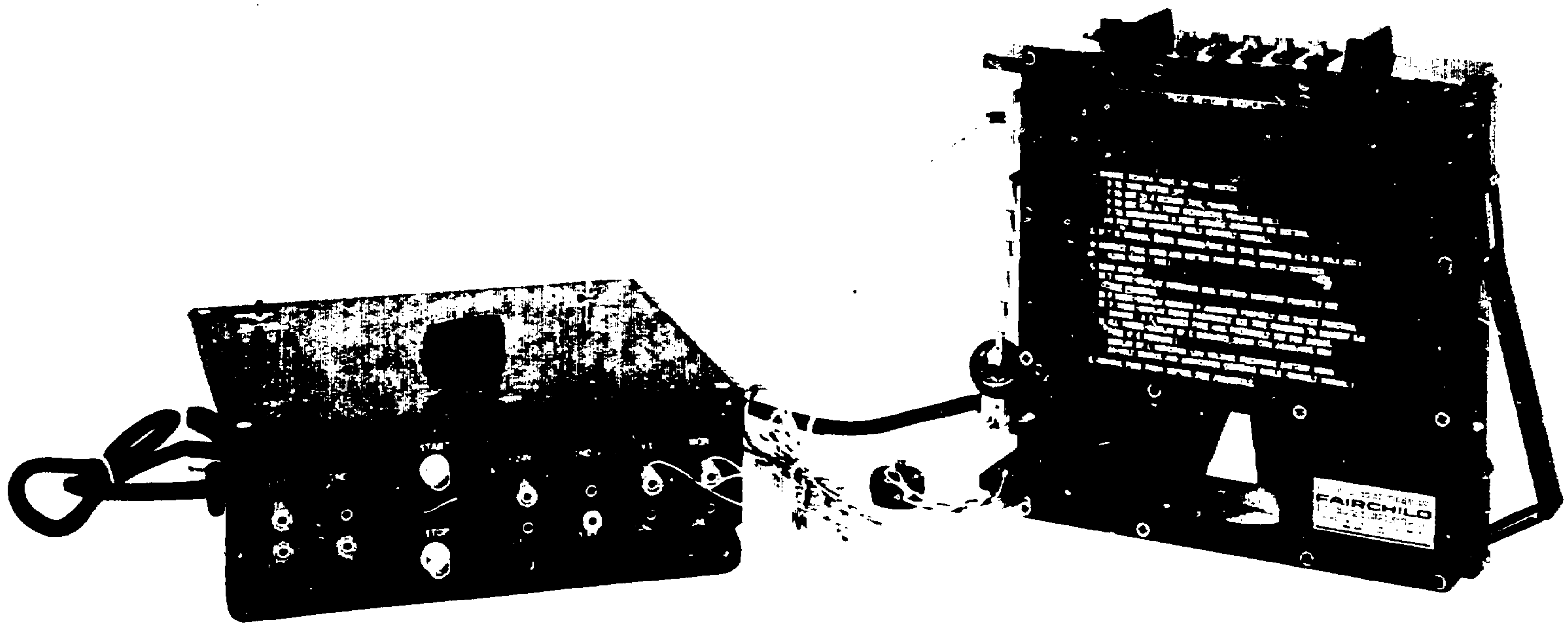

FIGURE 9. XM36E1 FUZE SETTER AND TEST SETUP (USING REMOTE PROBE CONNECTOR)

The test setup shown in figure 8 employs the nose cone to interface the fuze setter with the fuze circuitry. In figure 9, the remote probe connector and a cable are used to interface the fuze setter with the fuze circuitry. In this manner, the operation of both the setting contacts and the remote probe connector is verified during various stages of testing.

Fuze setters S/N 201 and 202 were fabricated using some non-MIL specified components to maintain acceptable schedule requirements, permitting timely delivery of the first two FAAS units. These substitute parts are listed below:

Item No.	MIL P/N	Qty. per unit	Substitute P/N
1	JM38510/05001 BCA	8	CD4011AD
2	JM38510/05003 BCA	6	CD4023AD
3	JM38510/05605 BCA	1	CD4024AD
4	JM38510/05603 BEA	2	CD4020AD
5	JM38510/05503 BEA	4	CD4049AD
6	JM38510/05504 BEA	6	CD4050AD

Following inspection and ambient tests, these units performed satisfactorily when subjected to the storage and operating temperature range and tested in accordance with TP 11711348. Detailed data for each unit are shown in the respective unit's First Article Inspection Report data logbooks.

Fuze setters S/N 203, 204 and 205 were tested in accordance with phases 1 through 13 of TP 11711348. These tests included the following temperatures and environments after baseline ambient data were taken:

(1) Low temperature in accordance with MIL-STD-810C, Method 502.1, Procedure I.

(2) High temperature in accordance with MIL-STD-810C, Method 501.1, Procedure I.

(3) Immersion in accordance with MIL-STD-810C, Method 512.1, Procedure I.

(4) Dust in accordance with MIL-STD-810C, Method 510.1.

(5) Shock in accordance with MIL-STD-810C, Method 516.2, Procedure II.

(6) Vibration in accordance with MIL-STD-810C, Method 514.2, Procedure XI.

(7) Electromagnetic interference in accordance with MIL-STD-461 and MIL-STD-462, Methods RE01, RE02, RS01, RS02, and RS03.

(8) Humidity in accordance with MIL-STD-810C, Method 507.1, Procedure II.

Fuze setter S/N 203 was tested in its carrying case and associated equipment.

The results of the environmental tests proved satisfactory with the following exceptions:

(1) A wiring error was found at the battery charge connector when unit S/N 205 was tested [2].

(2) Water leakage occurred during the immersion test with fuze setters S/N 203, 204, and 205 [3].

(3) A shorted battery charge cable caused a failure of fuze setters S/N 204 and 205 by applying the relatively high charging voltage to a low voltage circuit. [4]

(4) Fuze setters S/N 204 and 205 exceeded the maximum radiated narrow-band emission levels of the electromagnetic interference test. [5]

The following corrective action was taken for each malfunction.

(1) The wiring error was corrected and the tests were repeated with satisfactory results.

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(2) Q&R Failure Report, Fairchild, FR No. 6062-1, March 4, 1976
(3) Q&R Failure Report, Fairchild, FR No. 6062-2, March 4, 1976
(4) Q&R Failure Report, Fairchild, FR No. 6062-3, March 23, 1976
(5) Q&R Failure Report, Fairchild, FR No. 6062-4, March 23, 1976

(2) The fuze setter package design was modified to prevent water leakage by (1) capturing the antireflection filter gasket and setting switch gaskets, thereby allowing a more positive seal; and (2) replacing the setting contacts adhesive seal with a copper-clad epoxy board employing a solder seal and an O-ring.

The tests were then repeated with satisfactory results.

(3) The shorted battery charge cables and fuze setters were repaired and retested with satisfactory results.

(4) The narrow-band emissions radiated by the fuze setter were considered acceptable, since limits specified for this test normally apply to a steady-state condition and the fuze setter operates in a transient mode.

A detailed description of the environmental tests for each fuze setter S/N 203, 204, and 205 is contained in the respective unit's First Article Inspection Report data logbooks, and the referenced Failure Reports. All packaging changes were incorporated in all of the FAAS fuze setters, thereby concluding the environmental test program for these units.

3.4 Preproduction Lot I Units

Upon completion and approval of the five FAAS fuze setters, S/N 201 through 205, the preproduction lot I units were fabricated and tested. These ten units were designated S/N 206 through 215 and incorporated all changes and revisions as a result of the FAAS tests. Preliminary, small quantity production assembly procedures were prepared and employed during fabrication. These units were subjected to the storage and operating temperature range and tested in accordance with phases 1 through 6 of TP 11711348. All results were satisfactory with the following two exceptions:

(1) The maximum voltage for the correct operation of the battery "low voltage" circuit of fuze setter S/N 206 was outside the specified limit.[6]

(2) Several segments of an LED display failed to illuminate during the testing of fuze setter S/N 207.[7]

The following corrective action was taken for each malfunction.

(1) An analysis of the dc-to-dc converter transformer revealed an excessive number of turns in its secondary winding. The transformer was replaced and the tests were repeated with satisfactory results.

(2) The LED display was replaced and the failure was attributed to a manufacturing defect.

A detailed description of the tests for each of the lot I fuze setters, S/N 206 through 215, is contained in the respective unit Lot I Summary Report data logbooks, and the referenced Failure Reports.

3.5 GO and NO-GO Gages

Two electromechanical gages, the GO and NO-GO gages, were fabricated for testing the guide portion of the fuze setter. These gages verify the correct self-alignment features and mechanical interface between the fuze setter and a correctly fabricated fuze. The mechanical interface should always allow proper connections to be made between the fuze setter guide contacts and the fuze setting rings. A detailed description of the design characteristics was provided in a final report[1].

The GO gage (P/N 11711379) contains an actual fuze circuit and verifies that the fuze setter contacts protrude a sufficient length to make proper connection with the fuze. The schematic diagram for the GO gage is shown in figure 10. The NO-GO gage (P/N 11711390) contains a battery and lamp, and verifies that the fuze setter contacts are radially located within the specified limits. The schematic diagram for the NO-GO gage is shown in figure 11. Since each gage was designed within a nose cone, which is dimensioned to the maximum allowable contour of the actual fuze, the gage always fits "snugly" within the fuze setter guide and does not allow an operator's error.

(6) Q&R Failure Report, Fairchild, FR No. 6062-5, June 25, 1976
(7) Q&R Failure Report, Fairchild, FR No. 6062-6, June 25, 1976
(1) ibid.

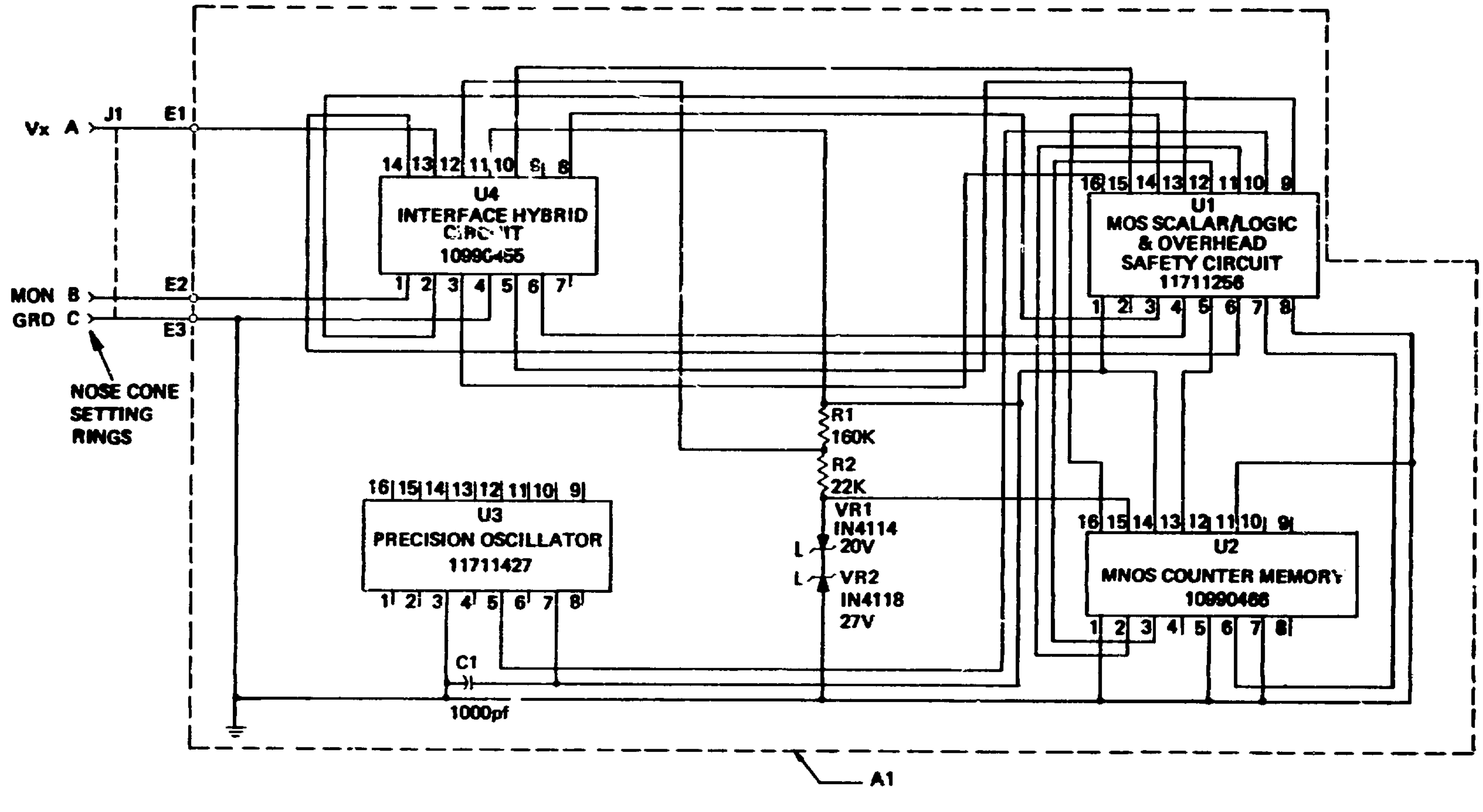

FIGURE 10. GO GAGE SCHEMATIC DIAGRAM

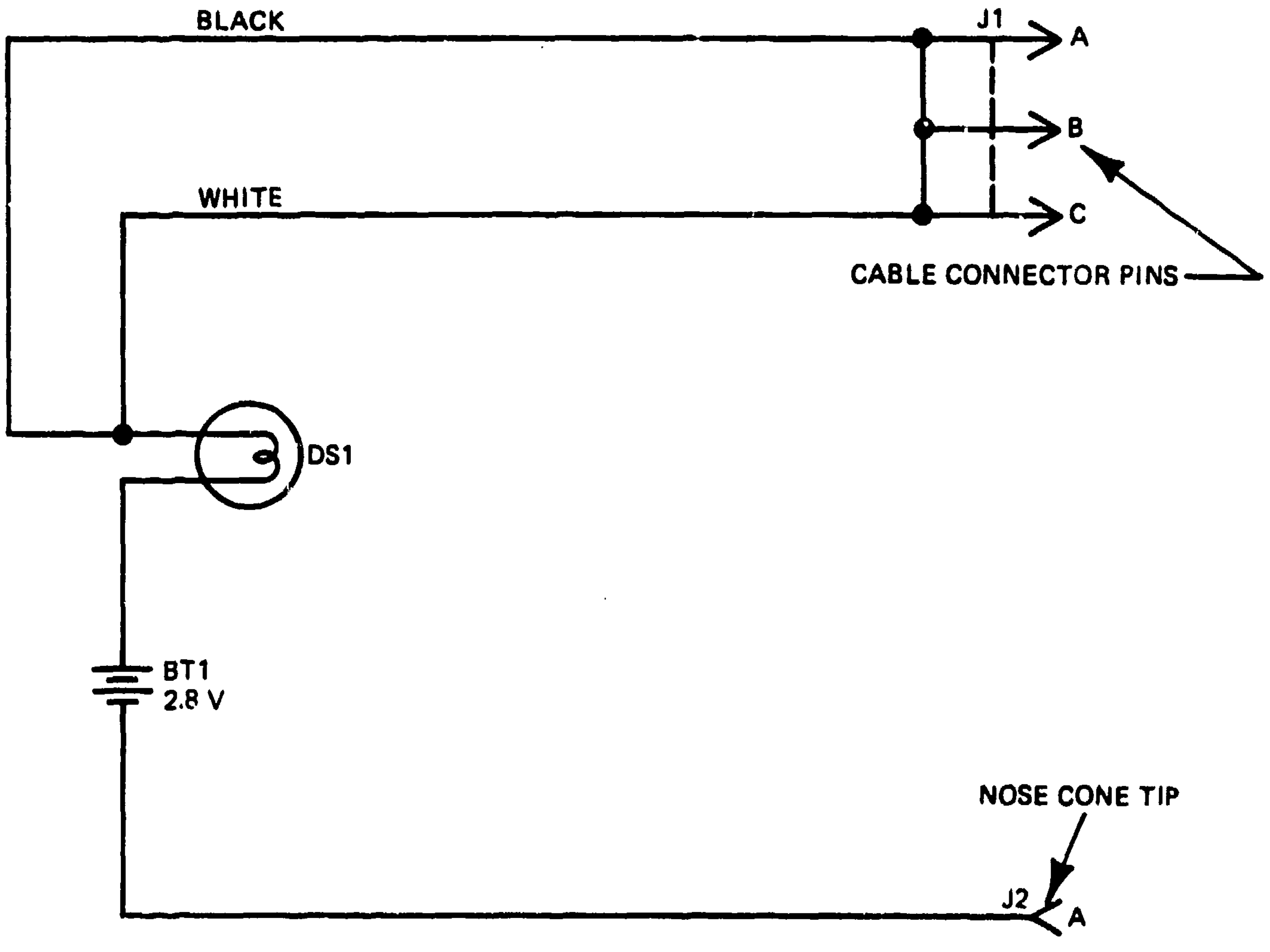

FIGURE 11. NO-GO GAGE SCHEMATIC DIAGRAM

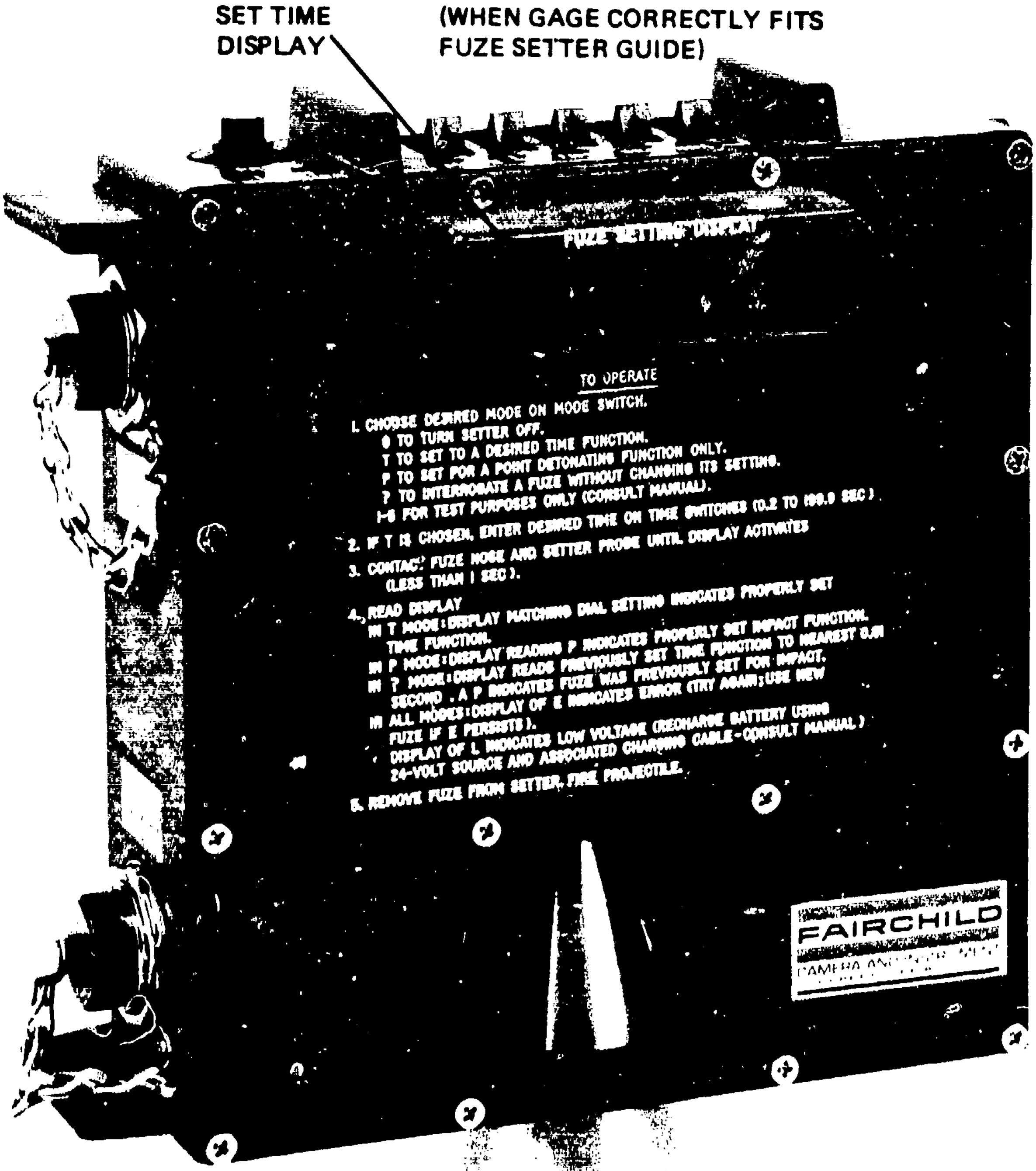

FIGURE 12. XM36E1 FUZE SETTER WITH GO GAGE

The fuze-setter test with the GO gage is shown in figure 12. Checking the fuze setter with the GO gage was accomplished by inserting the gage into the fuze-setter guide, with the mode switch in the T position. The set time selected on the setting switches (188.8) was displayed on the fuze-setter readout signifying correct guide alignment. Figure 13 shows the fuze-setter test with the NO-GO gage, which was accomplished by fastening the gage connector onto the fuze setter remote probe connector and inserting the NO-GO gage into the fuze-setter guide, with the mode switch in the Ø (off) position. The lamp within the NO-GO gage did not illuminate, signifying correct guide alignment. This lamp was initially verified by shorting the pins of the NO-GO gage connector to the nose cone and observing the lamp illumination.

The GO and NO-GO gages were employed to test each of the five FAAS fuze setters and each of the ten lot I units. Correct alignment was indicated in all fuze setters with both gages.

3.6 Battery Charge Cable

A 10-ft battery charge cable (P/N 11711399) was fabricated, tested, and delivered for each of the 15 Fuze Setters. This cable normally connects the fuze setter to the 24-V power source contained on military vehicles and self-propelled guns. Each cable was tested so that when 30 VDC was applied at one end and a load requiring 200mA was connected to the other end, a maximum voltage drop in the cable of significantly less than 0.5V was measured. Each cable was employed at various times during the testing of the fuze setter to charge the fuze setter battery, thereby verifying successful correct operation in actual usage.

3.7 Operating Instructions

A set of operating instructions (P/N 11711371) was prepared, reviewed, and approved by the Harry Diamond Laboratories. These operating instructions are shown in figure 14. Basically, these instructions are similar to those imprinted on the face of the fuze setter, but also contain an explanation of the various built-in fuze setter tests, use of the battery charging cable, and instructions for fuze-setter maintenance. These operating instructions are to be employed when setting a fuze and/or verifying the correct operation of a fuze setter. All relative switches, displays, and connectors are shown in figure 15.

Since these operating instructions were intended for field use, they were designed to be printed on a thin metal plate that would be contained in the fuze setter carrying case. This method of fabrication yields a product that is rugged, corrosion resistant, and suitable for operator usage in an artillery environment.

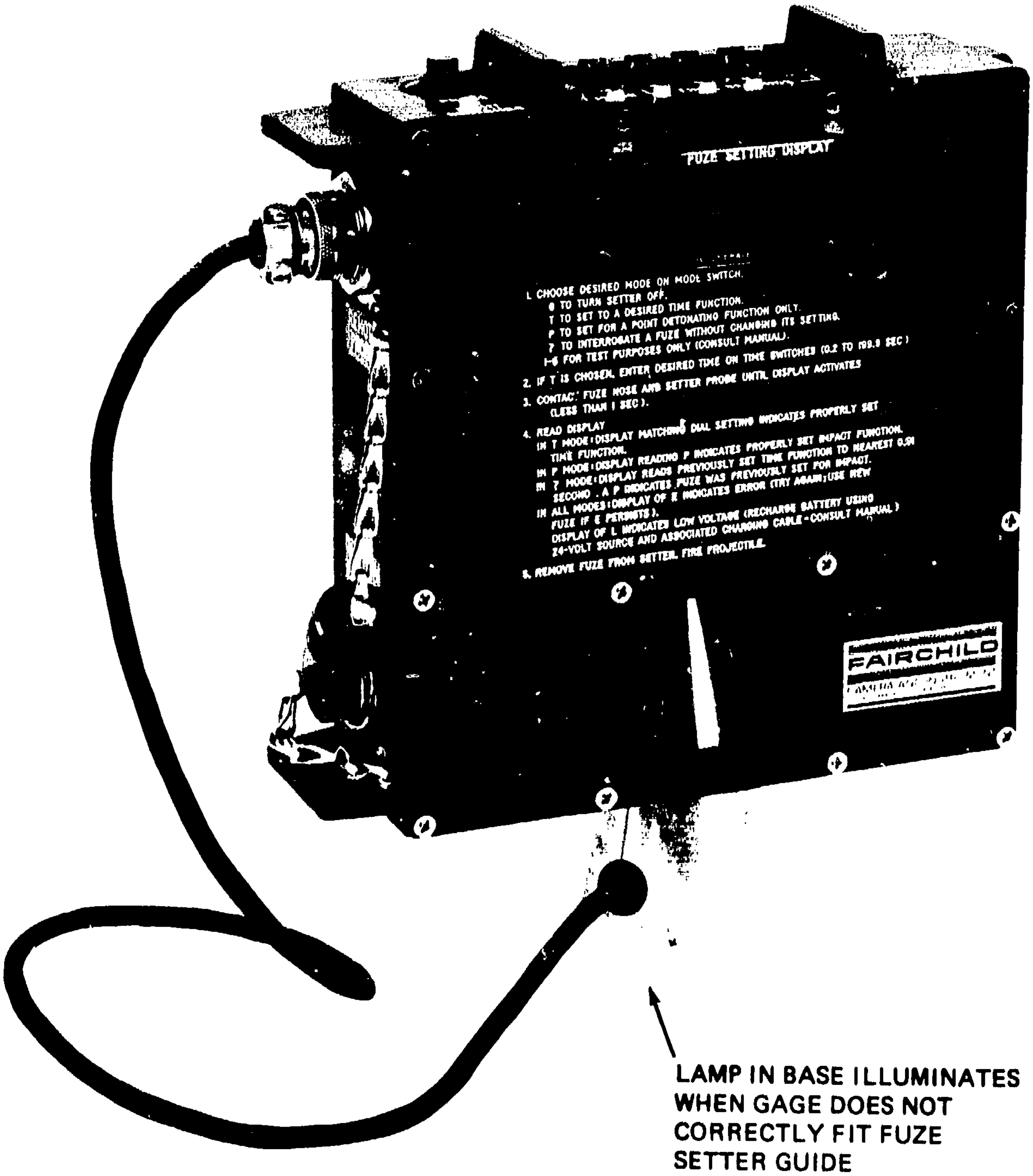

FIGURE 13. XM36E1 FUZE SETTER WITH NO-GO GAGE

FUZE SETTER: XM36E1
OPERATING INSTRUCTIONS

1. Illumination of setting switches.
   Press pushbutton to light setting switches (except when Mode switch is in Φ position).

2. Setting switch positions.

Mode:	Φ, T, ?, P, Φ, A, B, C, D, E
Time, sec(hundreds):	0, 1
Time, sec(tens):	0, 1, 2, 3, 4, 5, 6, 7, 8, 9
Time, sec(units):	0, 1, 2, 3, 4, 5, 6, 7, 8, 9
Time, sec(tenths):	0, 1, 2, 3, 4, 5, 6, 7, 8, 9

3. Display check (contact properly operating fuze nose and Fuze Setter probe).

Use T Mode set at 188.8	Display reads 188.8
Use P Mode	Display reads P
Use E Mode	Display reads LE

4. Choose desired mode on MODE switch.
   - Φ: To turn Fuze Setter off.
   - T: To set a desired time function.
   - P: To set a point detonating function only.
   - ?: To interrogate a fuze without changing its setting.
   - A-E: For test purposes only (all tests performed with a properly operating fuze).
     - A: To check Fuze Setter operation where fuze times out early.
     - B: To check Fuze Setter operation where fuze times out late.
     - C: To check Fuze Setter operation where fuze pulse widths are incorrect.
     - D: To check Fuze Setter operation where fuze clock is not operating.
     - E: To check Fuze Setter operation where fuze is disconnected from Fuze Setter before setting cycle is completed and also checks L display.

5. If T is chosen, enter desired time on setting switches (0.2 to 199.9 seconds).

6. Contact fuze nose and Fuze Setter probe until display activates (less than 1 second).

7. Read Display
   - In T Mode: Display matching dial setting indicates properly set time function.
     Display of E indicates error (Try again; use new fuze if E persists).
     Display will read E when trying to set 0.0 or 0.1 second.
   - In P Mode: Display of P indicates properly set impact function.
     Display of E indicates error (Try again; use new fuze if E persists).
   - In ? Mode: Display will read previously set time function to nearest 0.01 second (set time + .08 – .06).
     Display of P indicates fuze was previously set for impact.
     Display of E indicates error (Try again; use new fuze if E persists).
   - In A-D Modes: Display of E indicates proper Fuze Setter operation.
   - In E Mode: Display of LE indicates proper Fuze Setter operation.
   - In all Modes except E: Display of L indicates low voltage (recharge battery at earliest opportunity, within the temperature range of 32°F to 125°F, using Battery Charge Cable, P/N 11711399 and 24±4V, 150 MA DC power source normally available at the mating connector on military vehicles*).

8. Remove fuze from Fuze Setter when proper setting is displayed. Fire Projectile.

9. Fuze Setter probe contacts may be cleaned as required, using Bristle Brush H-B-185.

10. Remote Probe Connector is provided to permit remote setting of fuzes for future requirements.

* All self-propelled guns and tracked vehicles have a connector, located in the driver's compartment, which may be utilized to recharge the battery. The M35 2½-ton trucks are wired to receive a connector (utility outlet P/N 7064604), which is available from government inventory.

FIGURE 14. OPERATING INSTRUCTIONS

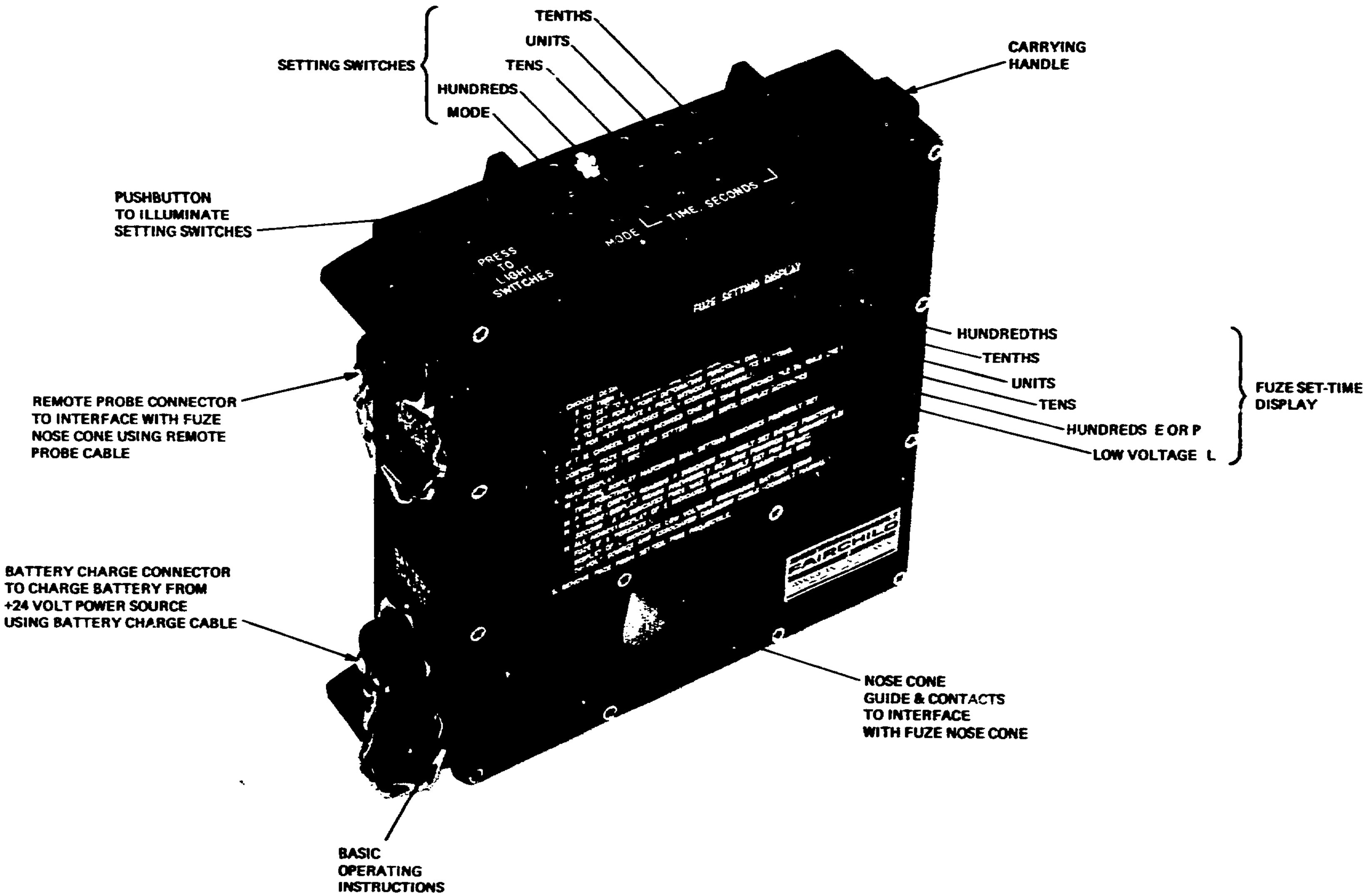

FIGURE 15. XM36E1 FUZE SETTER OPERATIONAL FEATURES

3.8 Carrying Case

A fuze setter carrying case (P/N 11711373) was designed and 15 units were fabricated, tested and delivered. This case was designed to contain the fuze setter, the battery charging cable, a bristle brush for cleaning the fuze-setter contacts, the operating instructions, and a desiccant bag. Figures 16 and 17 show the external and internal views of the carrying case.

The basic carrying case was designed to use the standard long-intrusion fuze ammunition cans. The carrying case insert was custom designed to house the various system components. Some of the pertinent features of this case include reusability, resilient insert material to minimize transportation shock, fungus resistance and completely sealed, as well as nonhygroscopic insert material, to prevent moisture absorption.

The carrying case, with the fuze setter and its accessories is shown in figure 18. A carrying case containing fuze setter, S/N 203, and all of its accessories was subjected to all of the environments during the FAAS test program. The results of this testing, which included subjection to low and high temperature, immersion, dust, shock, vibration, and humidity, were successful.

3.9 Battery Charge Circuit Modifications

The battery charge circuit was modified to extend the temperature range over which the battery may be charged. This circuit originally included a single resistor to limit the current to approximately 120 mA when charged from a 24-V power source. However, this limited the temperature range over which the battery may be charged, without degradation to its life, to between +32° and +125°F.

Upon consultation with the manufacturer of these batteries, it was found that the batteries may be charged between -40° and +145°F if the charge current is decreased at lower temperatures and increased at higher temperatures. Since this temperature range coincides with the fuze setter operating temperature range-i.e., battery discharge temperature range-a circuit was derived of a thermistor and an additional resistor to provide these required currents. This circuit is shown on the fuze setter detailed logic diagram, drawing No. 11711327, revision G.

The characteristics of the thermistor are such that at -40°F, the charge current is limited to approximately 10 mA; at +145°F, the charge current provided is approximately 180 mA. This is in accordance with the manufacturer's specifications for satisfactory battery operation. The modified battery charge circuit was, therefore, incorporated into the five FAAS fuze setters and the ten lot I fuze setters.

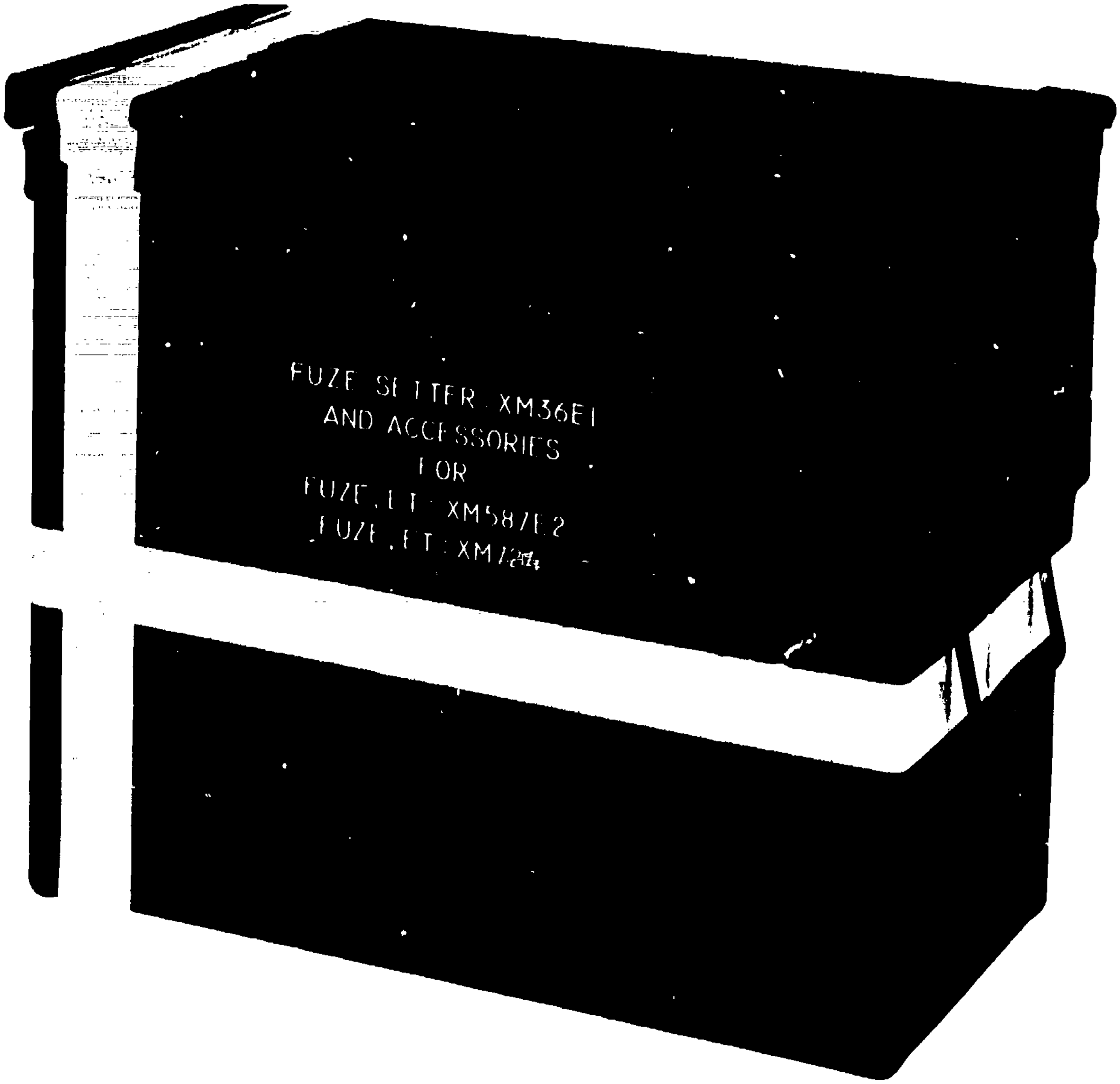

FIGURE 16. XM36E1 FUZE SETTER CARRYING CASE

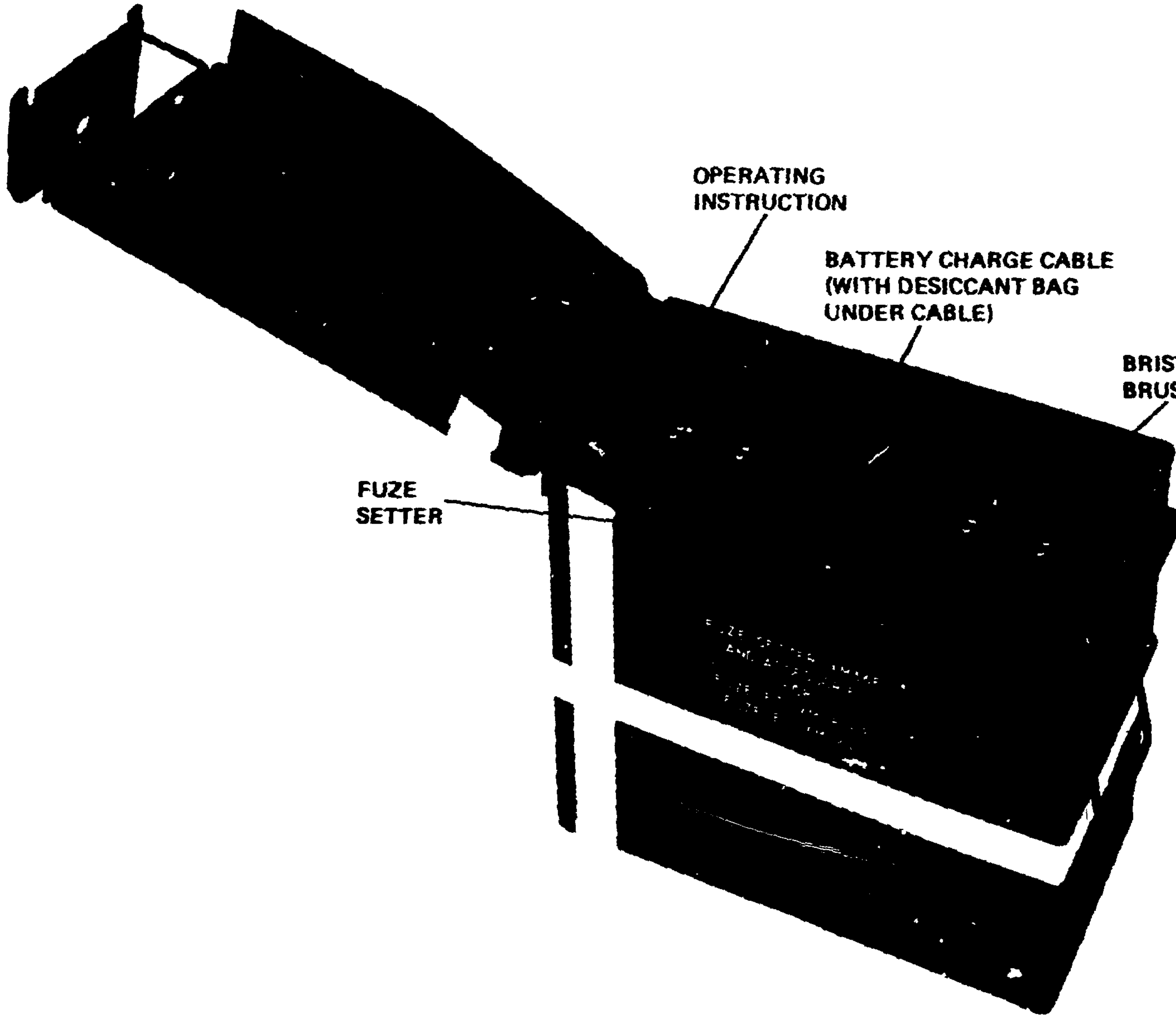

FIGURE 17. XM36E1 FUZE SETTER CARRYING CASE – INTERNAL VIEW

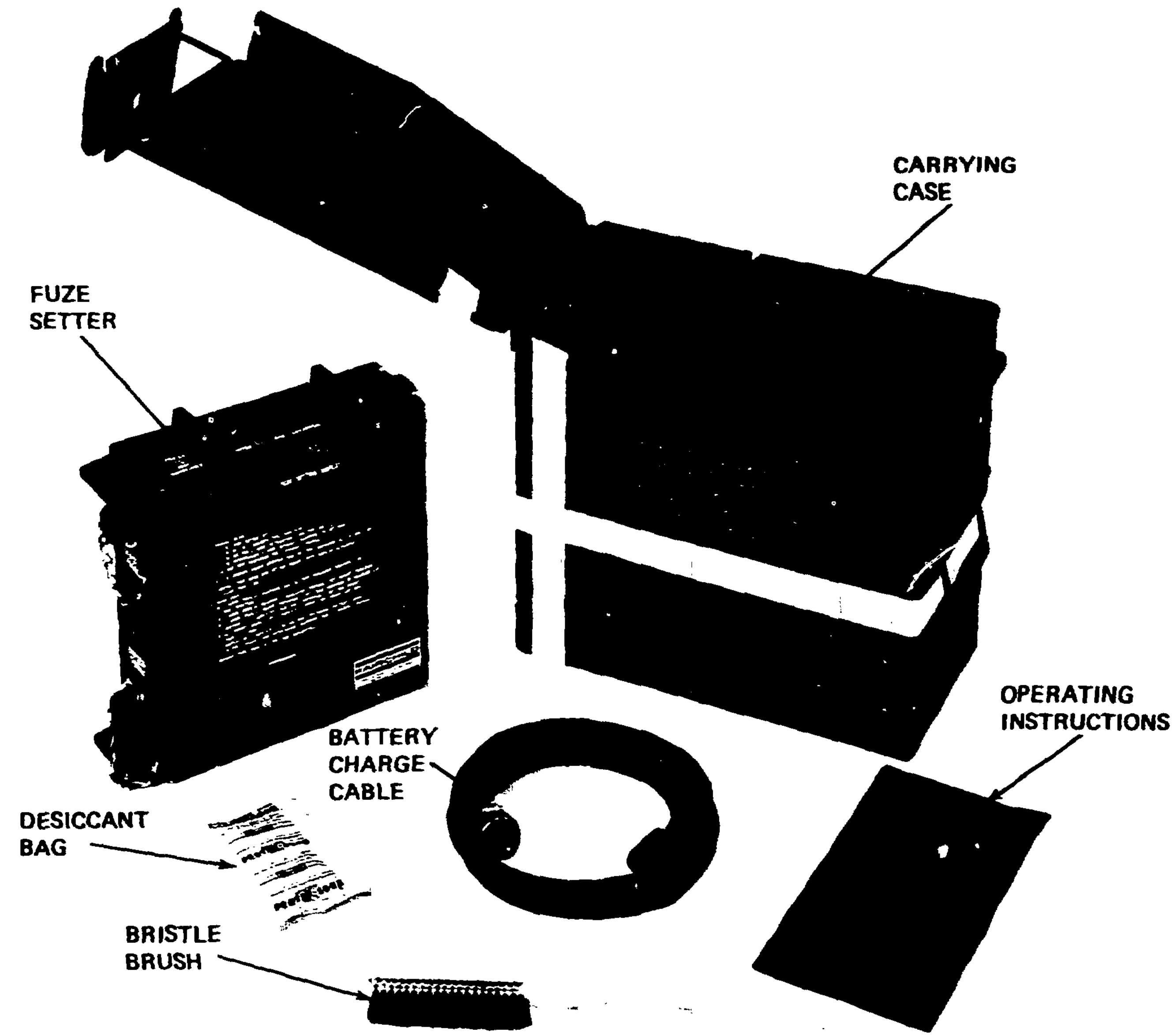

FIGURE 18. CARRYING CASE WITH XM36E1 FUZE SETTER AND ACCESSORIES

3.10 Engineering Change Proposals (ECP's)

During this program several drawing revisions were required. Minor changes were needed in some of the piece parts to improve design, ease fabrication, and correct minor errors. Requests for these changes were submitted via Engineering Change Proposals (ECP's).

The two major changes requiring ECP's were (1) due to the results of environmental testing, i.e., modification of the fuze setter package design due to leakage during the immersion test, and (2) the modification to the battery charge circuit for use over a wider temperature range. A summary of all ECP's for the fuze setter generated during this program is listed in table I.

Minor changes were also required for some of the piece parts of the fuze setter's associated equipment. These revisions were also requested via ECP's. A summary of the ECP's for the fuze setters' associated equipment is listed in table II.

3.11 Drawing Lists

Various changes and improvements have been incorporated in the fuze setter during this program. As previously mentioned, these changes have been covered in detail by ECP's. A list of drawings representing the 15 fuze setters, S/N 201 through S/N 215 is shown in table III. The list of drawings representing the auxiliary equipment for these 15 fuze setters is shown in table IV.

4. CONCLUSIONS AND RECOMMENDATIONS

4.1 Conclusions

The following conclusions are derived from the tasks performed during this program:

(1) The five FAAS fuze setters, S/N 201 through S/N 205, which were subjected to the environmental test program, show that the latest design will withstand the environments normally encountered in artillery field usage.

(2) The ten lot I preproduction fuze setters, S/N 206 through S/N 215, show that the fuze setter technical data package provides satisfactory information for the fabrication of production quantities of the fuze setter for field applications.

TABLE I. ENGINEERING CHANGE PROPOSALS
FOR FUZE SETTER: XM36E1

DWG. NO.	ECP. NO.	REVISIONS	
		FROM	TO
11711348	587-FS-1	C	D
	FSD-FS-035	D	E
DL11711348	FSD-FS-010	E	F
	FSD-FS-041	F	G
PL11711348	FSD-FS-040	D	E
11711327	FSD-FS-009	E	F
	FSD-FS-037	F	G
11711357	FSD-FS-026	B	C
	FSD-FS-038	C	D
11711344	587-FS-2	C	D
	587-FS-3	D	E
	FSD-FS-031	E	F
11711353	587-FS-4	A	B
11711309	587-FS-7	A	B
	FSD-FS-043	B	C
11711363	FSD-FS-030	NEW DWG.	-
11711325	FSD-FS-008	C	D
11711328	FSD-FS-039	C	D
11711347	587-FS-10	A	B
	FSD-FS-045	B	C
11711342	587-FS-12	B	C
	FSD-FS-032	C	D
11711343	587-FS-6	C	D
11711355	FSD-FS-005	B	C
11711351	587-FS-5	B	C
	FSD-FS-004	C	D
	FSD-FS-042	D	E
11711362	FSD-FS-036	NEW DWG.	-
11711361	587-FS-8	-	A
	FSD-FS-007	A	B
	FSD-FS-036	B	C
11711354	587-FS-11	B	C
	FSD-FS-001	C	D
	FSD-FS-033	D	E
11711358	FSD-FS-002	A	B
	FSD-FS-034	B	C
11711360	587-FS-9	A	B
	FSD-FS-003	B	C
	FSD-FS-044	C	D
11711320	FSD-FS-006	A	B

TABLE II. ENGINEERING CHANGE PROPOSALS FOR FUZE SETTER ASSOCIATED EQUIPMENT

DWG. NO.	ECP. NO.	REVISIONS	
		FROM	TO
	BATTERY CHARGE CABLE		
11711399	FSD-FS-012	-	A
DL11711399	FSD-FS-021	-	A
PL11711399	FSD-FS-022	-	A
	GO GAGE		
11711379	FSD-FS-019	-	A
DL11711379	FSD-FS-023	-	A
	FSD-FS-027	A	B
11711389	FSD-FS-020	-	A
11711378	FSD-FS-016	-	A
11711383	FSD-FS-015	-	A
11711382	FSD-FS-014	-	A
11711381	FSD-FS-011	-	A
11711380	FSD-FS-013	-	A
	NO-GO GAGE		
11711390	FSD-FS-018	-	A
DL11711390	FSD-FS-024	-	A
	FSD-FS-028	A	B
PL11711390	FSD-FS-025	-	A
11711389	FSD-FS-020	-	A
11711388	FSD-FS-017	-	A

TABLE III. FUZE SETTER: XM36E1 – DRAWING LIST (S/N 201-215)

DWG. NO.	REV.	TITLE
11711348	E	FUZE SETTER: XM36E1 ASSEMBLY
IL 11711348	A	FUZE SETTER: XM36E1 ASSEMBLY
DL11711348	G	FUZE SETTER: XM36E1 ASSEMBLY
PL11711348	E	FUZE SETTER: XM36E1 ASSEMBLY
11711327	G	FUZE SETTER: XM36E1 DETAILED LOGIC DIAGRAM
11711357	D	FUZE SETTER: XM36E1, WIRING DIAGRAM
11711344	F	HOUSING, FUZE SETTER
11711353	B	COVER, BATTERY
11711306		CUSHION, BATTERY
11711307		GASKET, PUSHBUTTON
11711363		GASKET, SWITCH
11711325	D	SWITCH, ROTARY
11711328	D	BATTERY, SEALED CELL
11711339	B	CAP, ELECTRICAL CONNECTOR
11711347	C	PLATE, HANDLE
11711346	A	HANDLE
11711345		LINK, HANDLE
11711342	D	COVER, CONTACT
11711343	D	RETAINER, CONTACT
11711355	C	CONTACT
11711351	E	GASKET, PANEL
11711362		PRINTED WIRING MASTER, CONTACT SEAL
11711356	B	PANEL ASSEMBLY
11711361	C	PANEL, FRONT
11711354	E	FILTER, ANTI-REFLECTION
11711358	C	ACRYLIC SUBSTRATE
11711360	D	GASKET, FILTER
11711305	A	SPACER
11711318	C	ELECTRONIC BOARD ASSEMBLY
11711320	B	JUMPER, PRINTED CIRCUIT BOARD
11711315	D	DISPLAY LOGIC BOARD ASSEMBLY
11711335	B	PRINTED WIRING MASTER, DISPLAY LOGIC
11711326	B	DISPLAY, SEVEN SEGMENT
11711359		MICROCIRCUIT, DIGITAL, CMOS, DECADE COUNTER/ DIVIDER, MONOLITHIC SILICON
11711316	D	CONTROL LOGIC BOARD ASSEMBLY
11711336	B	PRINTED WIRING MASTER, CONTROL LOGIC
11711317	D	POWER & INTERFACE BOARD ASSEMBLY
11711337	A	PRINTED WIRING MASTER, POWER & INTERFACE CIRCUITS
11711330	B	TRANSFORMER ASSEMBLY
11711329	B	ENCAPSULATION CUP
11711332		ENCAPSULATION CUP, ALTERATION
11711308		TERMINAL
11711331		TRANSFORMER, TOROIDAL
11711314	A	CORE, MAGNETIC

TABLE IV. FUZE SETTER: XM36E1
AUXILIARY EQUIPMENT DRAWING LIST

DWG. NO.	REV.	TITLE
11711372		FUZE SETTER: XM36E1 AND ACCESSORIES
IL 11711372		FUZE SETTER: XM36E1 AND ACCESSORIES
DL 11711372		FUZE SETTER: XM36E1 AND ACCESSORIES
PL11711372		FUZE SETTER: XM36E1 AND ACCESSORIES
11711373		CARRYING CASE, FUZE SETTER: XM36E1
11711374		COVER INSERT
11711375		PACKAGING INSERT
11711371		OPERATING INSTRUCTIONS
IL 11711371		OPERATING INSTRUCTIONS
DL11711371		OPERATING INSTRUCTIONS
PL11711371		OPERATING INSTRUCTIONS
11711399	A	CABLE, BATTERY CHARGE
IL 11711399		CABLE, BATTERY CHARGE
DL11711399	A	CABLE, BATTERY CHARGE
PL11711399	A	CABLE, BATTERY CHARGE
11711379	A	"GO" GAGE, FUZE SETTER
IL 11711379		"GO" GAGE, FUZE SETTER
DL11711379	B	"GO" GAGE, FUZE SETTER
PL11711379		"GO" GAGE, FUZE SETTER
11711377		"GO" GAGE SCHEMATIC DIAGRAM
11711389		NOSE CONE, GAGE
11711387		CAP, TRANSLUCENT
11711378	A	"GO" GAGE BOARD ASSEMBLY
11711376		PRINTED WIRING MASTER, GO GAGE
11711383	A	RING ASSEMBLY, CONTACT
11711382	A	ADAPTER, CONTACT MOUNTING
11711381	A	CONTACT, CENTER
11711380	A	RING, CONTACT
11711390	A	"NO-GO" GAGE, FUZE SETTER
IL 11711390		"NO-GO" GAGE, FUZE SETTER
DL11711390	B	"NO-GO" GAGE, FUZE SETTER
PL11711390	A	"NO-GO" GAGE, FUZE SETTER
11711389		NOSE CONE, GAGE
11711388	A	ADAPTER, CONTACT
11711387		CAP, TRANSLUCENT
11711386		CLIP, LAMP
11711385		CUSHION, BATTERY
11711384		BATTERY, "D" SIZE

(3) The tests performed on the fuze setter confirm that the latest design provides the operator with all of the features and instructions necessary for field usage.

(4) The fuze setter test program shows that a safe and reliable quality product can be produced with the use of the present tooling and gages employed during fuze setter fabrication.

(5) Testing of the fuze setter confirmed that the addition of the hood, around the read-out part of the cast panel, allowed the display to be visible in bright sunshine, bright cloudy weather, and on dark over-cast days.

(6) The addition of the remote probe connector proved useful in providing the fuze setter with the capability of remotely setting fuzes and also aiding in testing the fuze setter.

(7) Test results obtained with the fuze setter confirmed that the addition of the ruggedization bars to the latest design of the fuze setter cast housing protects the battery charge connector and remote probe connector during rough handling.

(8) The fuze setter accessories, including the carrying case, operating instructions, battery charge cable, and bristle brush for cleaning the contacts supplement the fuze setter, providing a complete system for field applications.

(9) The modification of the battery charge circuit extended the charging temperature range so that the complete operating temperature range for both charge and discharge of the entire fuze setter is from -40° to +145°F. However, the charging circuit provides higher currents than required at the cold temperatures when charged from a source voltage of 20 to 28V.

4.2 Recommendations

The following suggestions are recommended to enhance the fabrication of production quantities of the fuze setter for use in the field.

(1) A less dense insert material should be investigated to reduce the overall weight of the carrying case assembly, while maintaining its protective characteristics against the rough handling environments to which the fuze setter is subjected.

(2) Arrangement of the fuze setter circuitry should be investigated for providing a visual indication to the operator that the fuze setter battery is being charged when connected to an external 24-V source.

(3) The charging circuit should be investigated to control the charging current properly at cold temperatures, when the charging source varies between 20 and 28V.

(4) The battery charge cable connector which mates with the vehicle connector should be modified to make it more rugged and should be extended so that it can be easily inserted and disconnected by an operator wearing gloves.

(5) A remote probe and cable should be designed to facilitate the capability of remotely setting fuzes.

(6) The fuze setter assembly and manufacturing procedures should be reviewed from a production engineering standpoint to provide a more cost effective unit for large production quantities.

(7) A study should be initiated to determine the requirements for the design and development of production test equipment for the fuze setter, which would aid in minimizing the production costs for the fuze setter.

(8) A study should be initiated to determine the possible use of the fuze setter in applications that require the automated setting of fuzes and/or have the operator assisted by a computer.

The enactment of these suggestions will further enhance the fuze setter system, providing a more suited product for artillery field employment.

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